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(54) INFORMATION RECORDING/REPRODUCING DEVICE AND INFORMATION RECORDING/REPRODUCING MEDIUM

(57) An information recording/reproducing device and a medium are improved in reliability by making medium managing information usable even when a defective sector exists in the medium managing information area of the medium. The identifier of medium managing information, the information about the position where the medium managing information is recorded which is the information about the position of the sector in use, or the information about the position where a defect exists in the medium managing information area which is the information about the position of the defective sector are read from the medium managing information area of the medium (3) and all the information is stored in a RAM (8) by means of a medium managing information position managing means (5). A reproducing means (1) and a recording means (2) are controlled based on the information. Therefore, the medium managing information is correctly recorded and the reliability of the data of the information recording/reproducing device and the medium is improved, because the medium managing information is not recorded in the defective section.

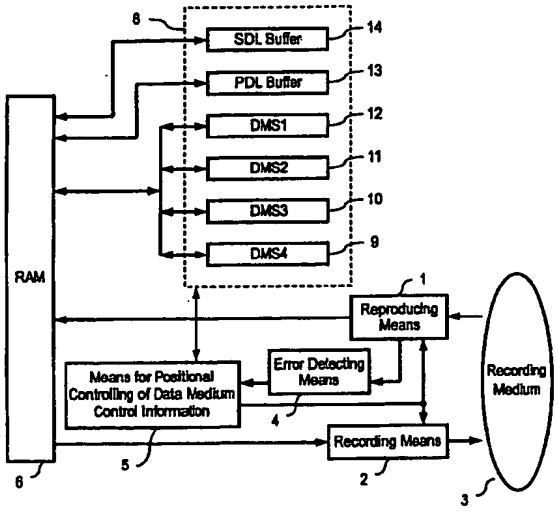

FIG. 1

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Descripti n

Field of the Invention

The present invention relates to an information recording/reproducing unit, whereby recording and reproducing of data are performed, and a data medium for use in the foregoing recording and reproducing of data.

Background of the Invention

An information recording/reproducing unit has so far been employing such a recording medium control system as described typically in the standards ISO10089, ISO10090 and ISO10091 for use with a magneto-optic disk, for example, whereby the recording area of a recording medium is broadly divided into three areas (user area, alternate area and data medium control area).

A user area is used for recording/reproducing the data required by higher level units. An alternate area is used as an alternate sector for alternate processing, wherein data are recorded, by substituting a defective sector in the user area. A data medium control area is used for recording/reproducing a defective list and alternate list to control the alternate processing.

When data is recorded in a user area of a recording medium, a determination is made on whether recording errors are generated or not, or whether data is correctly recorded or not, by a method of comparing signals obtained by reproducing immediately after recording the data with the data that was intended for recording, and the like for each respective sector, for example.

In general, recording errors are generated due to partial defects of a recording medium itself and a malfunction in the record system of a recording/reproducing unit. When recording errors are found to have been generated, the previous data is again recorded in an alternate sector within an alternate area by substituting the defective sector of the user area wherein recording of data was made before, and at the same time defects control information that provides positional information on the defective sector and alternate sector is recorded in the data medium control information area.

How these user area, alternate area and data medium control information area are structured can be determined arbitrarily. For example, a track of data medium on the disk of an information recording/reproducing unit as shown in Fig. 15 is defined as one of a plurality of paths formed on the data medium by the division thereof performed along the radius of the disk and each respective track of the above is divided along the direction of rotation into 16 segments, each being called a sector.

Assuming there are a data medium control information area, user data area and alternate area on the foregoing data medium, for example, Fig. 12 shows how a structure is formed on the record medium.

Here, 601 indicates a first data medium control information area, 602 indicates a second data medium control information area, 603 indicates a user area, 604 indicates an alternate area, 605 indicates a third data medium control information area and 606 indicates a fourth data medium control information area. The data medium control information is formed of the user area 603 detected at the time of initialization of a recording medium 600, primary defect lists (PDLs) 608a and 608b that keep the positional information on an alternate sector in the alternate area 604, secondary defect lists (SDLs) 609a and 609b that indicate a defective sector detected at the time of data recording in the user area and the positional information on an alternate sector in the alternate area with data recorded by substituting the defective sector, and a disk definition structure (DDS) 607 that indicates the start of data medium control information, fixed start addresses of PDLs 608a and 608b and SDLs 609a and 609b and a data structure on the record medium (positional information on ROM data, RAM data and the like). In other words, the date medium control information comprises DDS607, PDL608a and 608b, and SDL609a and 609b, and the similar data are recorded in each respective data medium control information area.

A RAM612 is a memory wherein reproduced data medium control information is stored. The description that follows employs SDL609a and 609b whereby data medium control information is updated when a defective sector is found.

The present example of prior art adopts a 2 sector state for both PDL and SDL.

When a recording medium 600 is loaded in a recording/reproducing unit for execution of data recording/reproducing, DDS607, PDL608a and 608b, and SDL609a and 609b are reproduced and then stored in a RAM612.

When data medium control information is changed, the SDL stored in the RAM 612 is recorded in each of the first to fourth data medium control information areas 601, 602, 605 and 606 on the recording medium, respectively. Accordingly, every time when a defective sector in the user area is detected, positional information on the defective sector, an alternate sector replacing the defective sector and the like is added to the RAM612, thereby updating the SDL in the RAM612. The SDL after the foregoing updating is recorded in each of the first to fourth data medium control information areas 601, 602, 605 and 606 on the recording medium, respectively. The SDL stored in the RAM612 is recorded in each of the first to fourth data medium control information areas 601, 602, 605 and 606 on the recording medium 600, respectively.

An example of the contents of these SDL809a and 809b is shown in Fig. 14(a), wherein the data unit of SDL is 1 byte, the reference numeral 800 shows a defect list identifier formed of 2 byte fixed data, the ref-

erence numeral 801 shows a reserved field held for future expansion, the reference numeral 802 shows the number of defective sectors held in the SDL, the reference numeral 803 is the address to show a location of a defective sector, the reference numeral 804 is the address to show a location of an alternate sector substituting the foregoing defective sector, and the reference 805 shows a blank field set aside for defective sectors that are detected in future.

Here, each respective positional information on a pair of defective sector and alternate sector is expressed by employing the data 803 and 804 formed of 8 bytes.

According to this SDL, it is understood that the number of defect cataloged is 1, the address (X1) is a defective sector and the address (Y1) is an alternate sector replacing the foregoing defective sector.

Thus, an inability to use data medium control information due to partial defects on a recording medium and the like has been prevented in the prior art by recording data medium control information in a plurality of data medium control information areas. However, when the data medium control information in RAM612 is recorded on a recording medium 600, the data of the RAM612 are sometimes not updated correctly because of partial defects on the recording medium. At this time, the data medium control information area is not allowed to read-in, resulting in a reduction of usable data medium control information areas by one.

Therefore, if there are any defective sectors, even only one, in the data medium control information area, the use of the data medium control information area becomes impossible. More specifically, a problem was encountered in the past that the entire data medium could not be used due to the existence of 4 defective sectors.

With the alternate list and defect list in the prior art, recording locations are fixed as shown in Fig. 12 and assuming that the number of byte for 1 sector is 512 bytes and defective and alternate sectors as many as 63 are cataloged in SDL, for example, this SDL becomes 512 bytes, resulting in using up exactly 1 sector.

Further, when an address (X2) to be used as the next SDL happens to be a defective sector, a sector on a certain user area is a defective sector. Assuming that recording is executed on that sector which is a defective sector, a recording error is caused, thereby generating an alternate sector with new addresses of defective sector and alternate sector cataloged in the SDL. As a result, the cataloged number becomes 64 and the number of byte used counts 520 bytes, exceeding the number of byte for 1 sector with a resulting addition of 1 sector to the SDL. This added SDL sector is recorded on a defective sector, resulting in an inability to use this SDL. Thus, the inability to use an SDL that has been usable till halfway happened all over the data medium control information area, resulting in a problem of not allowing recording or reproducing to be performed in any areas of the entire data medium.

Summary of the Invention

The present invention relates to an information recording/reproducing unit whereby data is recorded/reproduced and aims at enhancing the reliability of data recorded on a data medium by the information recording/reproducing unit.

In order to achieve the foregoing objective, the present invention discloses an information recording/reproducing unit comprising:

a data medium that allows recording/reproducing of data to be made on/from;
a recording means for recording data on a data medium; and
a reproducing means for reading out data from a data medium, wherein data medium control information is provided in the data medium formed of a single sector or a plurality of sectors for controlling attributes of the data medium, attributes of areas inside of the data medium and defect information, and positions for recording the data medium control information are not fixed.

Particularly, the present invention discloses an information recording/reproducing unit comprising:

an identifier adding means for adding data medium control information identifiers that identify data medium control information;
a defective sector detecting means for recording data medium control information by avoiding defective sectors;
an identifier discriminating means for selecting data medium control information identifiers at the time of reproducing and using data medium control information; and
a restructuring means of data medium control information for making connections of each respective data medium control information sector formed of a single sector or a plurality of sectors according to the selected identifiers and structuring into single data medium control information, wherein data medium control information areas are not fixed.

Furthermore, the present invention discloses an information recording/reproducing unit characterized by having at a specified position on the data medium data medium control positional information that is the positional information on each respective sector of the data medium control information and a means for positional controlling of data medium control information, whereby data medium control information is recorded/reproduced according to the foregoing positional information, wherein data medium control information areas are not fixed.

Moreover, the present invention discloses an information recording/reproducing unit characterized by having on a data medium, whereby data can be recorded/reproduced, data medium control information that is the information for controlling the attributes of a data medium and also of areas in the data medium and defect information at locations that are not fixed.

Therefore, according to the present invention's information recording/reproducing unit wherein data recording is performed by avoiding defective sectors, even when defective sectors are formed in the areas of the defect list and alternate list due to dusts and scars in the defective list and alternate list, initial defects of the data medium and deterioration of the data medium caused by repeated recordings, there is no possibility that the list in each respective area becomes unusable, thus allowing secure recording of data medium control information in the data medium to take place. As a result, the possibility of failure in recording data medium control information correctly due to defects of data medium is eliminated, thereby making it unlikely to happen that the data medium control information can not be retrieved. Thus, it is prevented from happening that all the user data on a data medium become unretrievable just because data medium control information can not be read out due to a failure in having the data medium control information correctly recorded because of defects in the data medium. In other words, the reliability of data recorded in a data medium by use of an information recording/reproducing unit is allowed to be enhanced greatly.

Brief Description of the Drawings

Fig. 1 is a block diagram of an information recording/reproducing unit in a first exemplary embodiment of the present invention.

Fig. 2 is a flow chart to show reproducing steps of the data medium control information area in the first exemplary embodiment of the present invention.

Fig. 3 shows a format of DMS that becomes the positional information of data medium control information in the first exemplary embodiment of the present invention.

Fig. 4 is the contents of DMS that show an example of the status wherein 2 sectors of PDL and 2 sectors of SDL of DMS that becomes the positional information of data medium control information in the first exemplary embodiment of the present invention.

Fig. 5 is a layout diagram to show an example of the data medium wherein 2 sectors of PDL and 2 sectors of SDL exist in the first exemplary embodiment of the present invention.

Fig. 6 is block diagram of an information recording/reproducing unit in a second exemplary embodiment of the present invention.

Fig. 7 shows an example of the contents of PDL in the second exemplary embodiment of the present invention.

Fig. 8 shows an example of the contents of SDL in the second exemplary embodiment of the present invention.

Fig. 9 is a layout diagram to show an example of the data medium wherein 2 sectors of PDL and 2 sectors of SDL exist in the second exemplary embodiment of the present invention.

Fig. 10 is a flow chart to show how SDL is recorded in the second exemplary embodiment of the present invention.

Fig. 11 is a flow chart to show how SDL is recorded in the second exemplary embodiment of the present invention.

Fig. 12 is a layout diagram to show an example of a prior art data medium wherein 2 sectors of PDL and 2 sectors of SDL exist.

Fig. 13 is a block diagram of a prior art information recording/reproducing unit.

Fig. 14 is an example of the format for SDL being an alternate list.

Fig. 15 is a diagram to describe how data medium control information is arranged on an ordinary disk type information recording medium.

Preferred Embodiments of the Invention

Next, a detailed explanation will be made on an exemplary embodiments of the present invention with reference to drawings.

Fig. 1 is a block diagram to show only the essential part of an information recording/reproducing unit in an exemplary embodiment of the present invention. In addition to what is described in Fig. 1, an information recording/reproducing unit requires an interface controlling means connected with higher level units, microprocessors that control the whole units and the like, but these are omitted from Fig. 1 since these have nothing to do with the present invention.

In Fig. 1 describing a first exemplary embodiment, the reference numeral 3 is a recording medium where data from higher level units is recorded/reproduced, reference numeral 8 is a data medium control information storage memory (RAM) wherein each of the reference numerals 9, 10, 11 and 12 shows positional information of data medium control information (DMS) in each of 4 data medium control information areas, reference numeral 13 shows a defective list (PDL), reference numeral 14 shows an alternate list (SDL), reference numeral 1 is a reproducing means for reproducing signals from the recording medium and changing the signals to binary signals, reference numeral 2 is a recording means for recording data and data medium control information on a data medium, reference numeral 6 is a buffer where each of the data medium control information read out by the reproducing means 6 is held temporarily, reference numeral 4 is an error detecting means for finding whether errors are gener-

ated or not during the reproducing and reference numeral 5 is a means for positional controlling of data medium control information for recording data medium control information or controlling reproducing positions.

Fig. 2 is a chart for explaining the steps to reproduce data medium control information as employed in the present invention. The data medium control information on the recording medium 3 is read out by the reproducing means 1 to obtain DMS, and then PDL and SDL are read out according to the positional information of data medium control information. At that time, each respective DMS and also PDL and SDL are stored in a data medium control information storage memory 8. Further, by use of the error detecting means 4 a determination is made on whether errors are generated or not at the time of recording or reproducing.

Fig. 3 is an example of the positional information of data medium control information as used in the present invention. The positional information of data medium control information deals with the foregoing DMS. The data unit of DMS is 1 byte and the reference numeral 300 is a DMS identifier formed of 2 byte fixed data, reference numeral 301 is a reserved field prepared for future expandability, reference numeral 302 is a PDL identifier to show PDL positional information, reference numeral 303 is the number of sectors that constitute PDL, reference numeral 304 shows each respective sector address that constitutes PDL, reference numeral 305 is an SDL identifier to show SDL positional information, reference numeral 306 is the number of sectors that constitute SDL and reference numeral 307 shows each respective sector address that constitutes SDL.

Next, how the problems described in the above are solved in the present exemplary embodiment will be explained.

Suppose that one sector of the recording medium comprises 512 bytes, the contents of DMS are as shown in Fig. 4 and arranged on the recording medium as shown in Fig. 5, SDL is constituted as shown in Fig. 14 in the same way as the prior art, and as many as 63 alternate sectors are already cataloged in SDL. Then, recording commands are issued from higher level units and against the designated area a detection is made that a recording operation address (X2) is a defective sector. The data designated to be recorded on the foregoing defective sector is recorded on an alternated sector at an address (Y2) of the alternate area. These defective sector and alternate sector are cataloged in SDL of RAM7 as shown in Fig. 3 (b). As a result, the cataloged number of alternate sectors becomes 64, thereby the number of sector in SDL being increased to two sectors since the number of byte in SDL exceeds 512.

Since the contents of SDL have been changed, SDL is recorded in the data medium control area of the data medium. This recording operation is performed against 4 data medium control areas. The recording operation against one of the foregoing data medium control areas will be explained below.

As a first step, a sector 511 is added to the sectors in use of SDL inside of DMS. A recording operation is performed against the first sector of SDL according to the SDL address in the foregoing DMS. Since the first sector of the SDL is not a defective sector, the recording operation is finished in a normal way. Then, a recording operation is performed for the second sector of SDL, resulting in an erroneous termination because the sector 511 is a defective sector. Therefore, a sector 512 of SDL is cataloged in DMS and a recording operation is performed against the sector 512, resulting in a normal termination of the recording operation since the sector 512 is not a defective sector.

An information recording/reproducing unit in a second exemplary embodiment of the present invention is described in a block diagram of Fig. 6, wherein the reference numeral 23 is a recording medium to record/reproduce data from higher level units, reference numeral 28 is a data medium control information storage memory (RAM) comprising a defective list (PDL) indicated by the reference numeral 33 and an alternate list (SDL) indicated by the reference numeral 34, reference numeral 21 is a reproducing means for reproducing signals from the recording medium 23 and changing the signals to binary signals, reference numeral 22 is a recording means for recording data and data medium control information on a data medium, reference numeral 26 is a buffer where each respective piece of the data medium control information read out by the reproducing means 21 is held temporarily, reference numeral 24 is an error detecting means for finding whether errors are generated or not during the process of reproducing and reference numeral 25 is a means for positional controlling of data medium control information for recording data medium control information or controlling reproducing positions.

The data medium control information on the recording medium 23 is accepted by the buffer 26 through the reproducing means as a whole like Fig. 9, for example. At that time, a determination is made on which of PDL or SDL each respective sector to be included in and where to be located therein by the means for positional controlling of data medium control information 25, utilizing each respective control information identifier located at the head of each respective selector, thereby restructuring PDL and SDL.

Fig. 7 shows an example of the contents of PDL used in the present invention. According to Fig. 7, as many as 200 defective sectors are cataloged in the PDL and the recording operation has taken place 3 times in total. How the PDL is restructured from each respective sector by the means for positional controlling of data medium con trol information is described below.

From the sectors accepted to the buffer by the means for positional controlling of data medium control information, sectors with PDL identifier are extracted and from the extracted sectors with PDL identifier are further

extracted sectors having the largest number of recording times.

Each time when one recording operation is finished, "1" is added to the previous number, thus establishing the number of PDL recording and identifying the PDL that has been recorded lastly. Here, suppose the recording operation has been performed 3 times and the PDL with the number of recording times of 3 are selected. Then, the PDL with the number of recording times of 3 are rearranged according to the order of PDL selector location number. Thus, the PDL located in the data medium control information area are restructured and stored in a PDL storage area and also each respective sector's address of the PDL used in the foregoing restructuring is stored in a PDL address storage area in the memory storing data medium control information.

Fig. 8 shows an example of the contents of SDL used in the present invention. As many as 100 defective sectors are cataloged in the SDL, indicating that recordings of 100 times in total have been performed.

Next, an explanation will be made on how this SDL is restructured from each respective sector by the means for positional controlling of data medium control information. From the sectors accepted to the buffer by the means for positional controlling of data medium control information, sectors having an SDL identifier are extracted and from the foregoing sectors with SDL identifier are further extracted the ones that have the largest number of recording times. Each time when one recording operation is finished, "1" is added to the previous number, thus establishing the number of SDL recording and identifying the SDL that has been recorded lastly. Here, suppose the recording operation has been performed 100 times and the SDL with the number of recording times of 100 are selected. Then, the SDL with the number of recording times of 100 are rearranged according to the order of SDL selector location number. Thus, the SDL located in the data medium control information area are restructured and stored in a SDL storage area and also each respective sector's address of the SDL used in the foregoing restructuring is stored in a SDL address storage area in the memory storing data medium control information.

Fig. 9 shows an example of the status on the foregoing disk. The unused sectors of Fig. 9 are the sectors that could not be used due to defects and the like or could not be needed to use. PDL1 and PDL2 are the sectors used as PDL and SDL1 and SDL2 are the sectors used as SDL.

Next, an explanation will be made on how recordings are performed when defects are found on a user area and the number of sectors of SDL is increased by registering an alternate sector.

(1) An explanation will be made with reference to the flow chart as shown in Fig. 10. First of all, a first unused sector address is searched in the data medium control area and a recording is performed on the unused sector.

When the recording has been performed normally, this address is added to an area storing the SDL address and the processing is ended. When the recording has not been performed normally, the next unused sector address is searched and an attempt is made to record the same content in an SDL sector on the foregoing next unused sector address. Accordingly, recordings on unused sectors are attempted one after another in the data medium control information area. When recordings have been performed normally, the addresses normally recorded are added to an area storing the SDL address and the processing is ended.

(2) An explanation will be made with reference to the flow chart as shown in Fig. 11. First of all, an used sector with the largest address is searched in the data medium control area and this address is designated as A.

In Fig. 9, the address of SDL 2 corresponds to this address. Then, an unused sector address located immediately after A is searched and a recording is performed on the unused sector. When the recording has been performed normally, this address is added to an area storing the SDL address and the processing is ended. When the recording has not been performed normally, the next unused sector address is searched and an attempt is made to record the same content in an SDL sector on the foregoing next unused sector address. Accordingly, recordings on unused sectors are attempted one after another in the data medium control information area.

After recordings in unused sectors have been attempted one after another and when the ending address is reached in the data medium control area, the processing returns to the beginning of the data medium control area and an unused sector is searched. Recordings on unused sectors are further attempted one after another, and when the address A is again reached it is judged that no more unused sectors for normal recordings are available in this data medium control area. When recordings have been performed normally, the addresses normally recorded are added to an area storing the SDL address and the processing is ended.

Accordingly, recordings can be performed without fixing the locations of data medium control information like PDL and SDL. Since the recordings in the present exemplary embodiment are not performed with the data medium control information situated only at the fixed locations in the same way as in the first exemplary embodiment, the aforementioned problems can be solved.

Industrial Applicability

As described in the above, the information recording/reproducing unit and data medium of the present invention enable identifying the location of data medium control information and performing the recording/reproducing of data medium control information by adding

identifiers, whereby recording locations of the information that constitutes data medium control information are identified within a data medium. Furthermore, performing recording/reproducing of data medium control information by possessing within the data medium a recording location of the information that constitutes positional information of data medium control information and utilizing the positional information of data medium control information has eliminated the possibilities of not recording data medium control information normally due to defective sectors and enabled recording of data medium control information securely in data medium, thereby allowing the reliability of an information recording/reproducing unit and data in recording medium for use in processing massive and important data to achieve improvements.

Key to Reference Numerals

In Exemplary Embodiments of the Present Invention

1 Reproducing means for reading out data from a data medium.
2 Recording means for recording data on a data medium.
3 Record medium.
4 Error detecting means for detecting errors at the time of reproducing data from a data medium.
5 Means for positional controlling of data medium control information for controlling recording/reproducing positions of data medium control information.
6 Buffer RAM for use in temporary storage at the time of recording/reproducing of data.
8 RAM for storing data medium control information.
9 RAM for storing DMS4 serving as positional information of a fourth data medium control area.
10 RAM for storing DMS3 serving as positional information of a third data medium control area.
11 RAM for storing DMS2 serving as positional information of a second data medium control area.
12 RAM for storing DMS1 serving as positional information of a first data medium control area.
13 RAM for storing PDL serving as a defect list.
14 RAM for storing SDL serving as an alternate list.
21 Reproducing means for reading out data from a data medium.
22 Recording means for recording data on a data medium.
23 Record medium.
24 Error detecting means for detecting errors at the time of reproducing data from a data medium.
25 Means for positional controlling of data medium information for restructuring data medium control information.
26 Buffer RAM for use in temporary storage at the time of recording/reproducing of data.
27 RAM for storing data medium control information.
31 PDL address storing area on RAM for storing PDL addresses.
32 PDL address storing area on RAM for storing SDL addresses.
33 RAM for storing PDL serving as a defect list.
34 RAM for storing SDL serving as an alternate list.

In Prior Art Examples

701 Reproducing means for reading out data from a data medium.
702 Recording means for recording data on a data medium.
703 Record medium.
704 Error detecting means for detecting errors at the time of reproducing data from a data medium.
705 Buffer RAM for use in temporary storage at th time of recording/reproducing of data.
706 RAM for storing data medium control information.
708 RAM for storing SDL serving as an alternate list.
709 RAM for storing PDL serving as a defect list.

Claims

1. An information recording/reproducing unit comprising:

a data medium that is capable of recording/reproducing data;
a recording means for recording data on said data medium; and
a reproducing means for reading out data from said data medium, wherein said data medium formed of a single sector or a plurality of sectors is provided with data medium control information that controls attributes of the data medium, attributes of areas in the data medium and information on defects in the data medium and locations where the data control information is recorded are not fixed.

2. The information recording/reproducing unit according to Claim 1, further comprising:

an identifier adding means for adding data medium control information identifiers that are identifiers of said data medium control information;
a defective sector detecting means for recording data medium control information by avoiding defective sectors;
an identifier discriminating means for discriminating said data medium control information

identifiers when data medium control information is reproduced and used; and

a means for positional controlling of data medium control information for connecting each other data medium control information sectors that are formed of a single sector or a plurality of sectors according to the identifiers that have been identified to structure into a piece of data medium control information, wherein data medium control information areas are not fixed.

3. The information recording/reproducing unit according to Claim 2, wherein data medium control information areas for recording data medium control information in said data medium are located at specified positions on said data medium and locations for recording each sector of data medium control information formed of a single sector or a plurality of sectors are allowed not to be fixed and not to be continued in said areas.

4. The information recording/reproducing unit according to Claim 1, wherein data control positional information on a position of each respective sector of said data medium control information is located at specified positions on said data medium, a means for positional controlling of data medium control information for recording or reproducing data medium control information according to the positional information is in place and data medium control information areas are not fixed.

5. The information recording/reproducing unit according to Claim 4, wherein data medium control information areas for recording data medium control information are located at specified positions on said data medium and locations for recording each sector of data medium control information formed of a single sector or a plurality of sectors in said areas are allowed not to be fixed and not to be continued.

6. An information recording/reproducing data medium serving as a data medium, whereby recording/reproducing of data can be performed, and characterized by providing on said data medium with data medium control information being information for controlling attributes of data medium, and area attributes and defect information within data medium and by having said data medium control information at areas that are not fixed.

7. The information recording/reproducing data medium according to Claim 6, characterized by possessing data medium control information identifiers serving as identifiers of said data medium control information, by having each data medium control information sector formed of a single sector or a plurality of sectors connected by the identified identifiers when data medium control information is reproduced for use and by having data medium control information to be restructured into a piece of data medium control information provided in areas that are not fixed.

8. The information recording/reproducing data medium according to Claim 7, characterized by having data medium control information areas, where data medium control information is recorded in said data medium, provided at specified locations on said data medium and by allowing the locations, where each sector of data medium control information formed of a single sector or a plurality of sectors is recorded, not to be fixed and not to be continued in said areas.

9. The information recording/reproducing data medium according to Claim 6, characterized by possessing data control positional information serving as each sector's positional information of said data medium control information at specified locations on said data medium and by having data control information areas that are not fixed in location and record or reproduce data medium control information according to said positional information.

10. The information recording/reproducing data medium according to Claim 9, characterized by possessing data medium control information areas, where data medium information is recorded in said data medium, at specified locations on said data medium and by allowing the locations, where each sector of data medium control information formed of a single sector or a plurality of sectors is recorded, not to be fixed and not to be continued in said areas.

11. The information recording/reproducing unit according to Claim 3, wherein data medium control information areas for recording data medium control information in said data medium are provided at specified locations on said data medium and each sector of data medium control information formed of a single sector or a plurality of sectors is recorded by avoiding defective sectors in said areas.

12. The information recording/reproducing unit according to Claim 5, wherein data medium control information areas for recording data medium control information in said data medium are provided at specified locations on said data medium and each sector of data medium control information formed of a single sector or a plurality of sectors is recorded by avoiding defective sectors in said areas.

13. The information recording/reproducing unit accord-

ing to Claim 7, wherein data medium control information areas for recording data medium control information in said data medium are provided at specified locations on said data medium and each sector of data medium control information formed of a single sector or a plurality of sectors is recorded by avoiding defective sectors in said areas.

14. The information recording/reproducing unit according to Claim 10, wherein data medium control information areas for recording data medium control information in said data medium are provided at specified locations on said data medium and each sector of data medium control information formed of a single sector or a plurality of sectors is recorded by avoiding defective sectors in said areas.

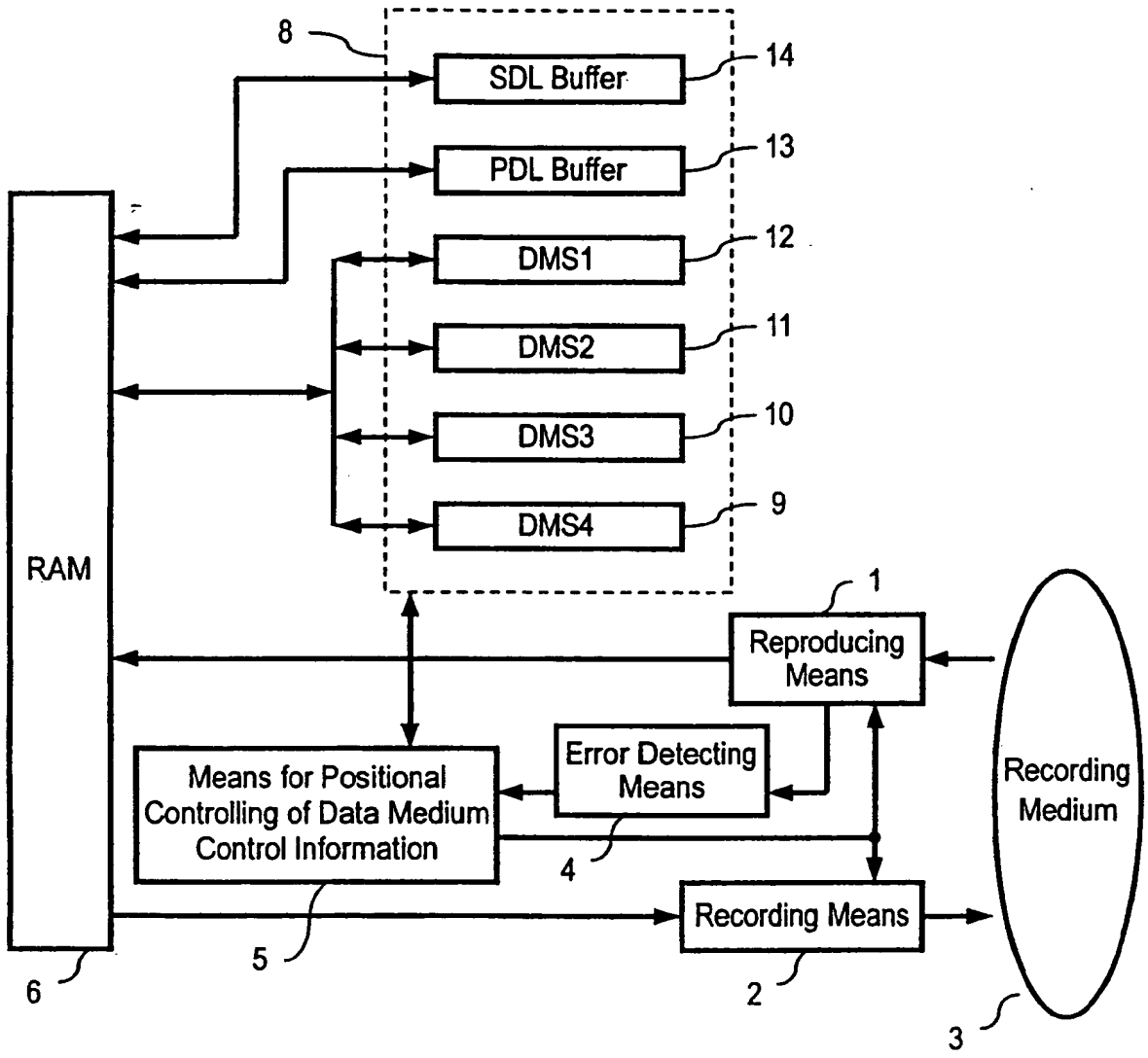
8
SDL Buffer
14
PDL Buffer
13
DMS1
12
DMS2
11
DMS3
10
DMS4
9
RAM
1
Reproducing Means
Error Detecting Means
Means for Positional Controlling of Data Medium Control Information
4
Recording Medium
Recording Means
5
6
2
3

FIG. 1

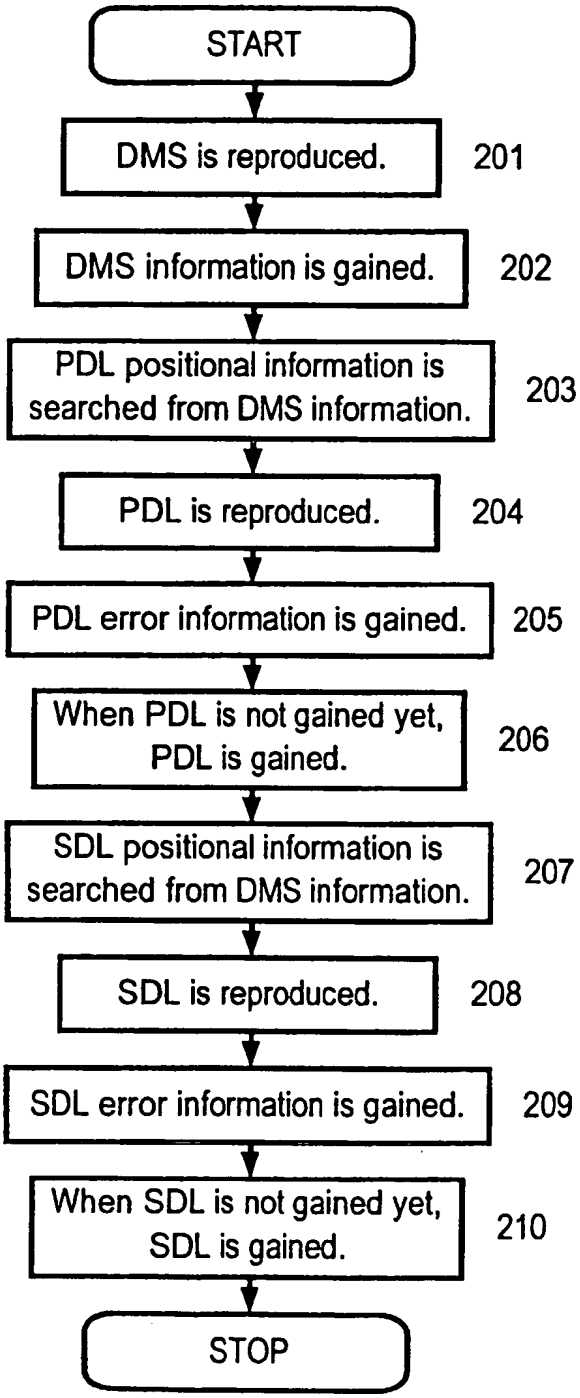
START
DMS is reproduced.
201
DMS information is gained.
202
PDL positional information is searched from DMS information.
203
PDL is reproduced.
204
PDL error information is gained.
205
When PDL is not gained yet, PDL is gained.
206
SDL positional information is searched from DMS information.
207
SDL is reproduced.
208
SDL error information is gained.
209
When SDL is not gained yet, SDL is gained.
210
STOP

FIG. 2

Byte	Contents	
0	(44h) DMS Identifier	300
1	(4Dh) DMS Identifier	
2 ~ 5	Hold	301
6	PDL Identifier	302
7	PDL Sector Number (n)	303
8	Address of PDL Sector 1	304
9	Address of PDL Sector 1	
10	Address of PDL Sector 1	
11	Address of PDL Sector 1	
⋮	⋮	
x	Hold	
x + 1	Hold	
x + 2	SDL Identifier	305
x + 3	SDL Sector Number (m)	306
x + 4	Address of SDL Sector 1	307
x + 5	Address of SDL Sector 1	
x + 6	Address of SDL Sector 1	
x + 7	Address of SDL Sector 1	
⋮	⋮	
y	Hold	
⋮	⋮	
511	⋮	

$x = (n * 4) + 8$

$y = x + (m * 4) + 4$

FIG. 3

Byte		Contents
0	44h	DMS Identifier
1	4Dh	DMS Identifier
2	00h	Hold
3	00h	Hold
4	00h	Hold
5	00h	Hold
6	01h	PDL Identifier
7	02h	PDL Sector Number (n)
8	00h	Address of PDL Sector 1
9	00h	Address of PDL Sector 1
10	00h	Address of PDL Sector 1
11	02h	Address of PDL Sector 1
12	00h	Address of PDL Sector 2
13	00h	Address of PDL Sector 2
14	00h	Address of PDL Sector 2
15	03h	Address of PDL Sector 2
16	00h	Hold
17	00h	Hold
18	02h	SDL Identifier
19	02h	SDL Sector Number (m)
20	00h	Address of SDL Sector 1
21	00h	Address of SDL Sector 1
22	00h	Address of SDL Sector 1
23	04h	Address of SDL Sector 1
24	00h	Address of SDL Sector 2
25	00h	Address of SDL Sector 2
26	00h	Address of SDL Sector 2
27	05h	Address of SDL Sector 2
28	00h	
⋮	⋮	Hold
511	00h	

FIG. 4

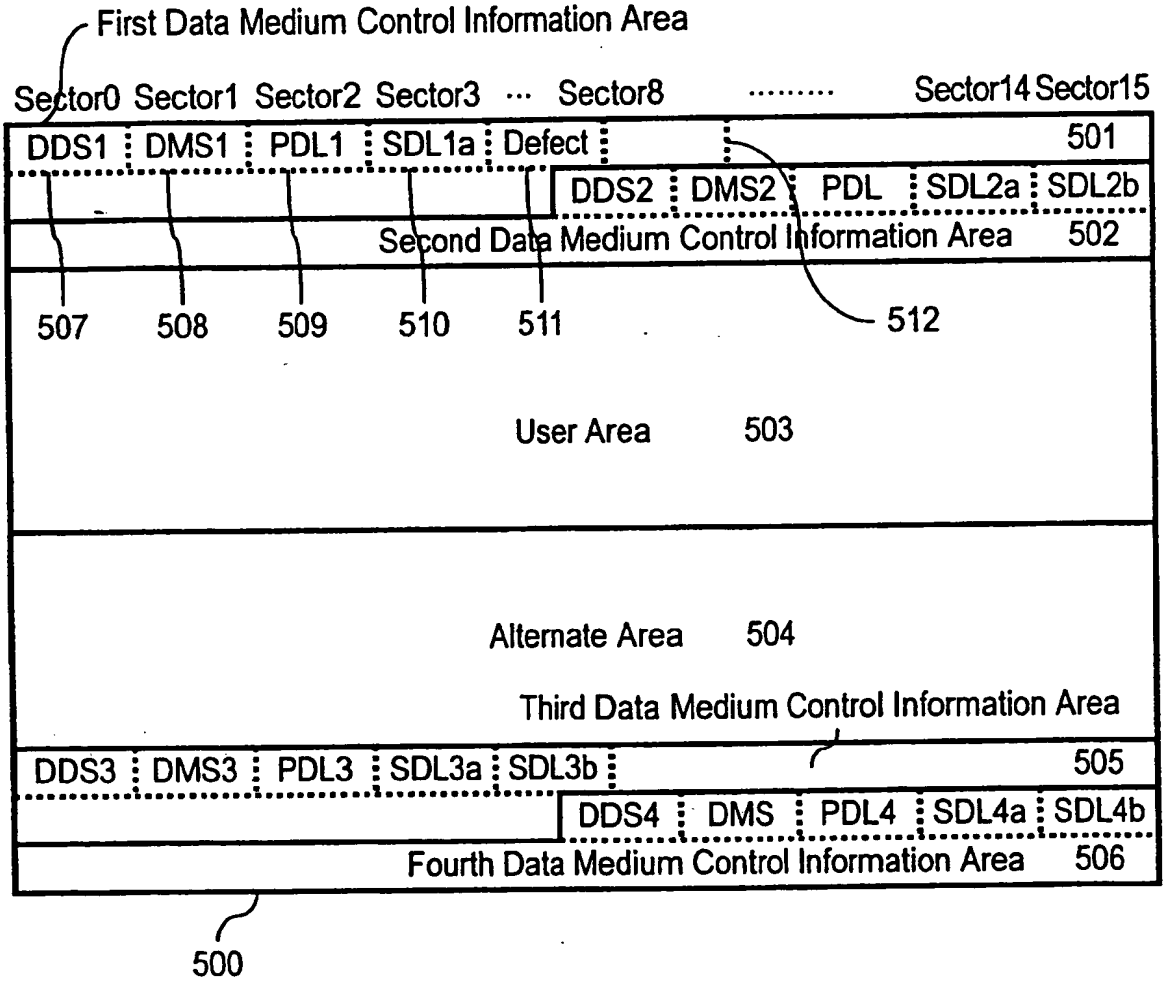
First Data Medium Control Information Area
Sector0 Sector1 Sector2 Sector3 ··· Sector8 ····· Sector14 Sector15
DDS1 DMS1 PDL1 SDL1a Defect
501
DDS2 DMS2 PDL SDL2a SDL2b
Second Data Medium Control Information Area 502
507 508 509 510 511
512
User Area 503
Alternate Area 504
Third Data Medium Control Information Area
DDS3 DMS3 PDL3 SDL3a SDL3b
505
DDS4 DMS PDL4 SDL4a SDL4b
Fourth Data Medium Control Information Area 506
500

FIG. 5

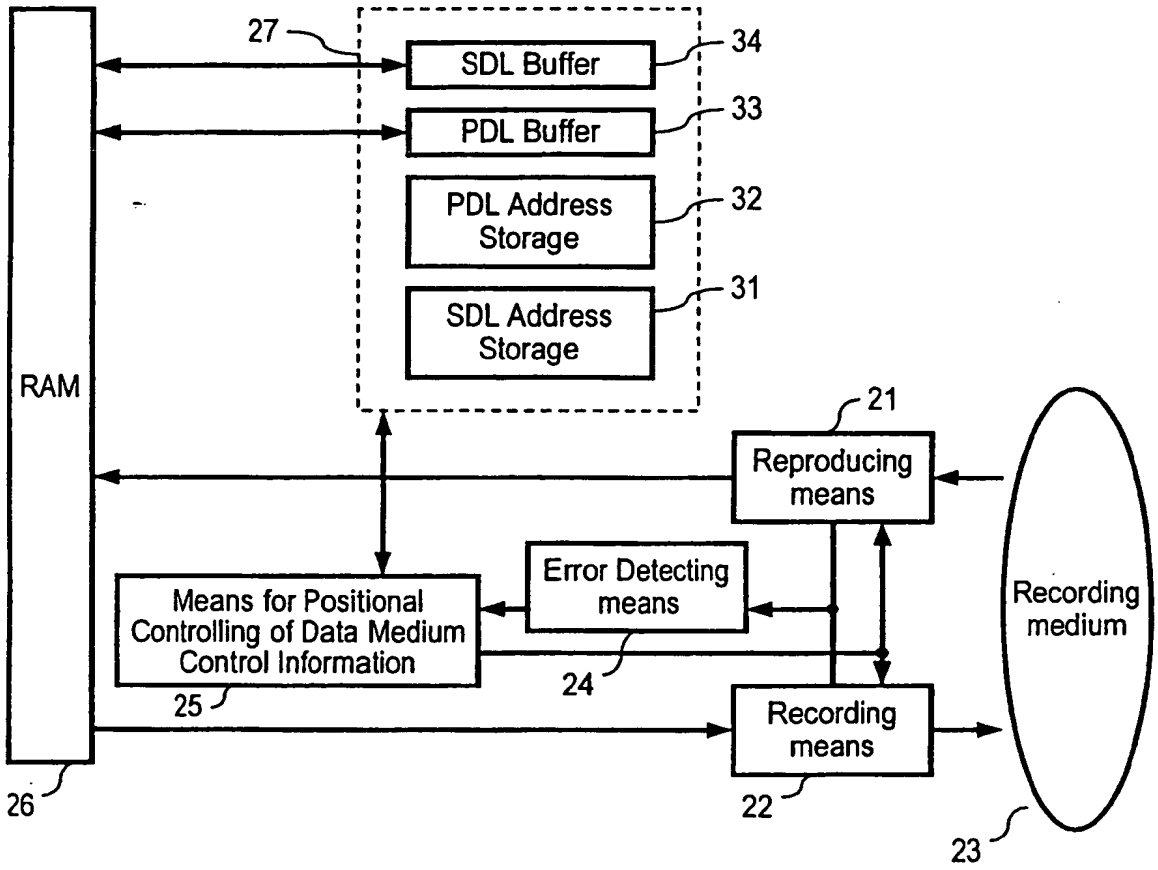
27
SDL Buffer
34
PDL Buffer
33
PDL Address Storage
32
SDL Address Storage
31
RAM
21
Reproducing means
Error Detecting means
Means for Positional Controlling of Data Medium Control Information
24
25
Recording means
Recording medium
26
22
23

FIG. 6

PDL Sector 1

Byte	Contents
0	PDL Identifier 1 (01h)
1	PDL Identifier 2 (01h)
2	Location Number of PDL Sector (00h)
3	Number of PDL Sector (02h)
4 ~ 5	Recording Times of PDL (0003h)
6 ~ 7	Number of PDL Directories (00C8h)
8 ~ 11	Address of First Defective Sector
12 ~ 15	Address of Second Defective Sector
⋮	⋮
(n*4) ~ (n*4)+3	Address of "n"th Defective Sector
⋮	⋮
508 ~ 511	Address of 126th Defective Sector

PDL Sector 2

Byte	Contents
0	PDL Identifier 1 (01)
1	PDL Identifier 2 (01)
2	Location Number of PDL Sector (01)
3	Number of PDL Sector (02)
4 ~ 5	Recording Times of PDL (0003h)
6 ~ 7	Number of PDL Directories (00C8h)
8 ~ 11	Address of 127th Defective Sector
12 ~ 15	Address of 128th Defective Sector
⋮	⋮
304 ~ 307	Address of 200th Defective Sector
308 ~ 511	Hold

FIG. 7

SDL Sector 1

Byte	Contents
0	SDL Identifier 1 (02h)
1	SDL Identifier 2 (01h)
2	Location Number of PDL Sector (00h)
3	Number of SDL Sector (02h)
4 ~ 5	Recording Times of SDL (0064h)
6 ~ 7	Number of SDL Directories (0064h)
8 ~ 11	Address of First Defective Sector
12 ~ 15	Address of First Alternate Sector
16 ~ 19	Address of Second Defective Sector
20 ~ 23	Address of Second Alternate Sector
⋮	⋮
(n∗8) ~ (n∗8)+7	Address of "m"th Defective Sector
(m∗8)+8 ~ (m∗8)+15	Address of "m"th Alternate Sector
⋮	⋮
504 ~ 507	Address of 63rd Defective Sector
508 ~ 511	Address of 63rd Alternate Sector

SDL Sector 2

Byte	Contents
0	SDL Identifier 1 (02h)
1	SDL Identifier 2 (01h)
2	Location Number of SDL Sector (01h)
3	Number of SDL Sector (02h)
4 ~ 5	Recording Times of SDL (0064h)
6 ~ 7	Number of SDL Directories (0064h)
8 ~ 11	Address of 64th Defective Sector
12 ~ 15	Address of 64th Alternate Sector
16 ~ 19	Address of 65th Defective Sector
20 ~ 23	Address of 65th Alternate Sector
⋮	⋮
304 ~ 307	Address of 100th Defective Sector
308 ~ 311	Address of 100th Alternate Sector
312 ~ 511	Hold

FIG. 8

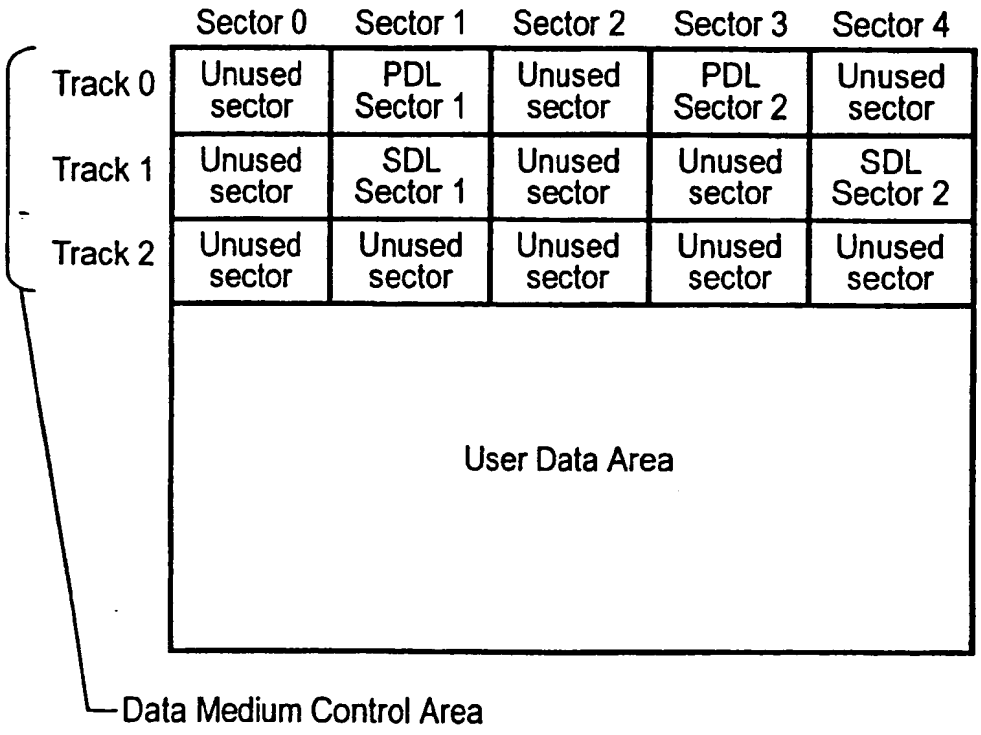
Sector 0
Sector 1
Sector 2
Sector 3
Sector 4
Track 0
Unused sector
PDL Sector 1
Unused sector
PDL Sector 2
Unused sector
Track 1
Unused sector
SDL Sector 1
Unused sector
Unused sector
SDL Sector 2
Track 2
Unused sector
Unused sector
Unused sector
Unused sector
Unused sector
User Data Area
Data Medium Control Area

FIG. 9

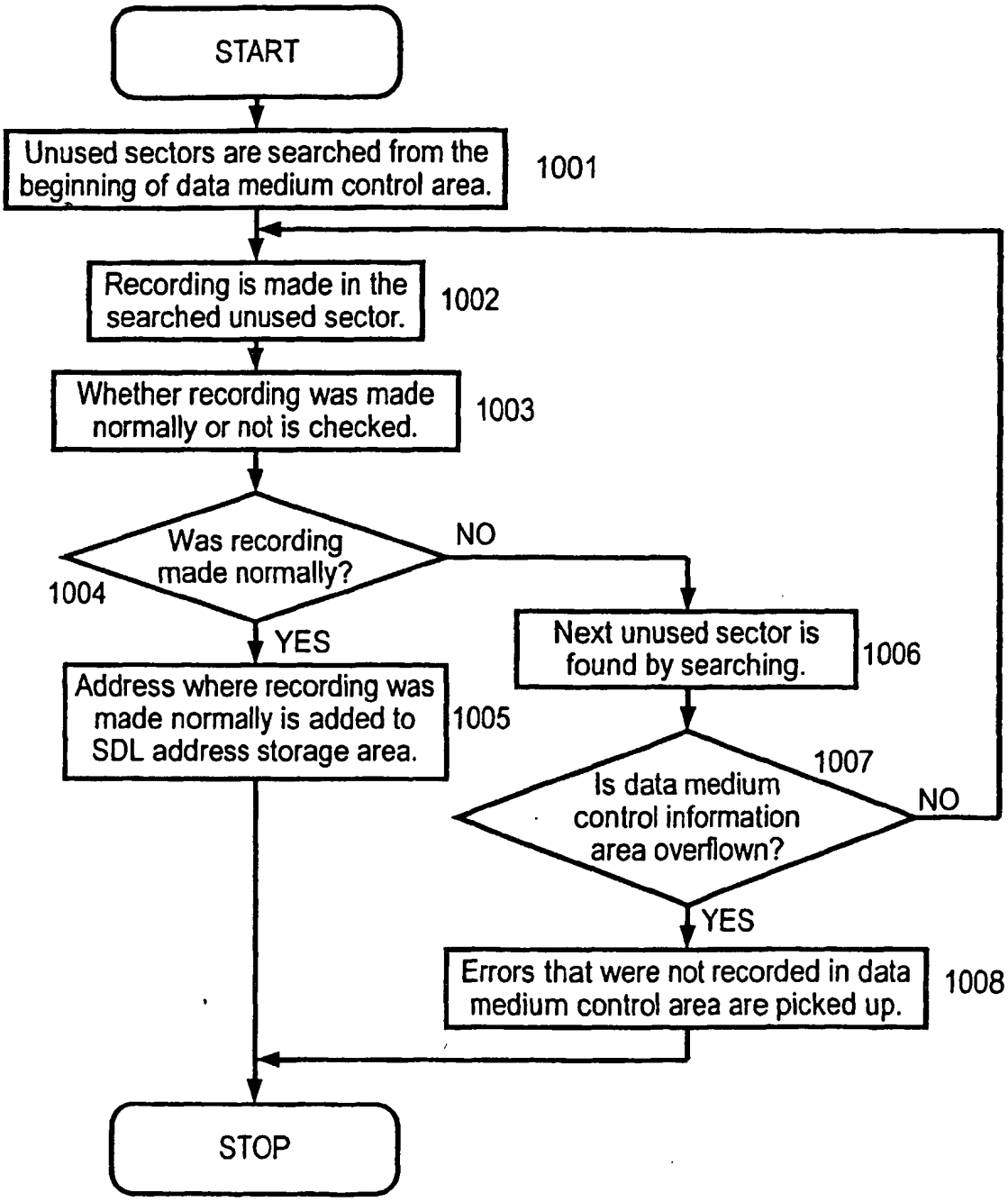
START
Unused sectors are searched from the beginning of data medium control area.
1001
Recording is made in the searched unused sector.
1002
Whether recording was made normally or not is checked.
1003
Was recording made normally?
1004
NO
YES
Address where recording was made normally is added to SDL address storage area.
1005
Next unused sector is found by searching.
1006
Is data medium control information area overflown?
1007
NO
YES
Errors that were not recorded in data medium control area are picked up.
1008
STOP

FIG. 10

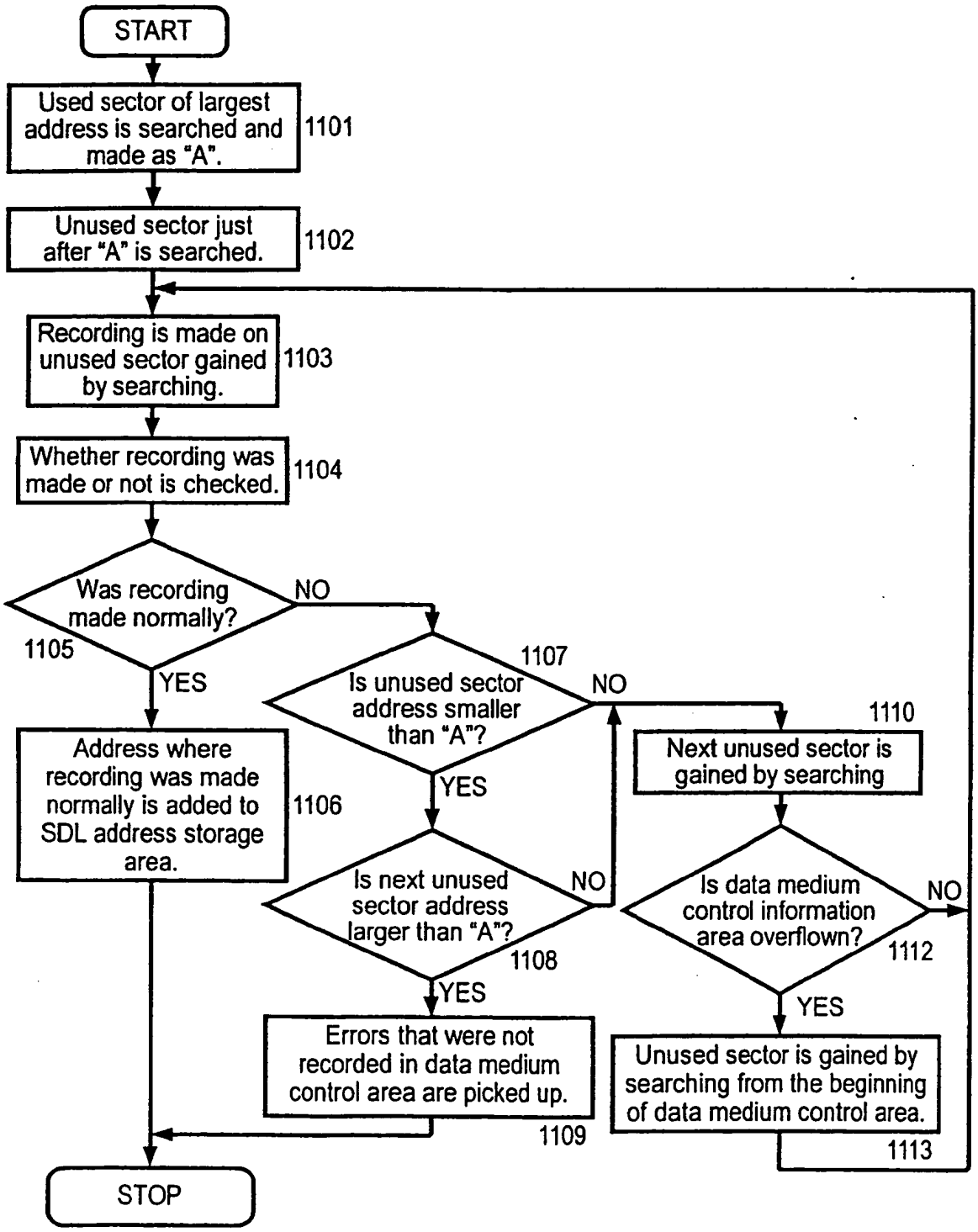
START
Used sector of largest address is searched and made as "A".
1101
Unused sector just after "A" is searched.
1102
Recording is made on unused sector gained by searching.
1103
Whether recording was made or not is checked.
1104
Was recording made normally?
1105
NO
YES
Address where recording was made normally is added to SDL address storage area.
1106
Is unused sector address smaller than "A"?
1107
NO
YES
Is next unused sector address larger than "A"?
1108
NO
YES
Errors that were not recorded in data medium control area are picked up.
1109
Next unused sector is gained by searching
1110
Is data medium control information area overflown?
1112
NO
YES
Unused sector is gained by searching from the beginning of data medium control area.
1113
STOP

FIG. 11

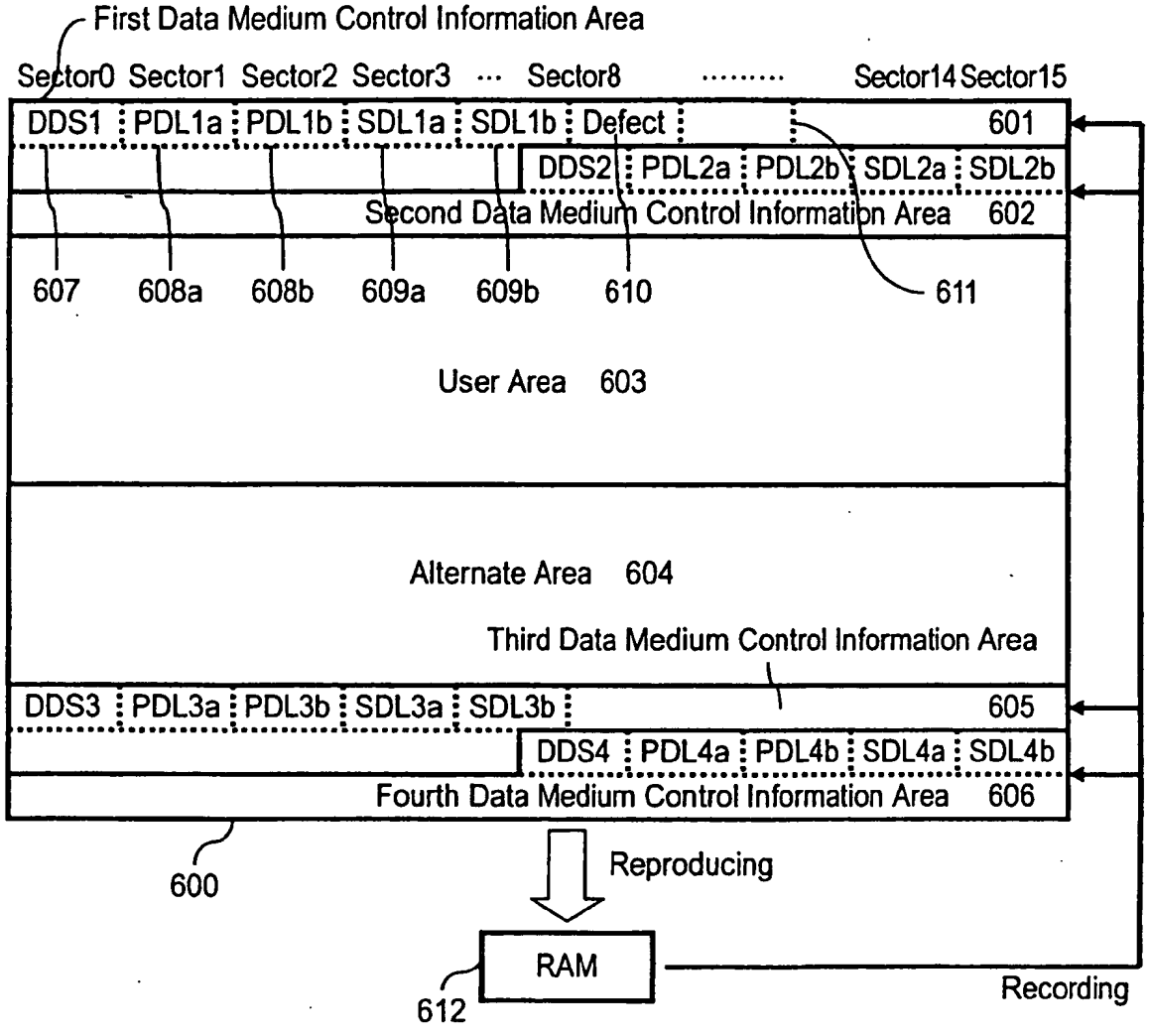
First Data Medium Control Information Area
Sector0 Sector1 Sector2 Sector3 ··· Sector8 ····· Sector14 Sector15
DDS1 PDL1a PDL1b SDL1a SDL1b Defect 601
DDS2 PDL2a PDL2b SDL2a SDL2b
Second Data Medium Control Information Area 602
607 608a 608b 609a 609b 610 611
User Area 603
Alternate Area 604
Third Data Medium Control Information Area
DDS3 PDL3a PDL3b SDL3a SDL3b 605
DDS4 PDL4a PDL4b SDL4a SDL4b
Fourth Data Medium Control Information Area 606
600
Reproducing
RAM
612
Recording

FIG. 12

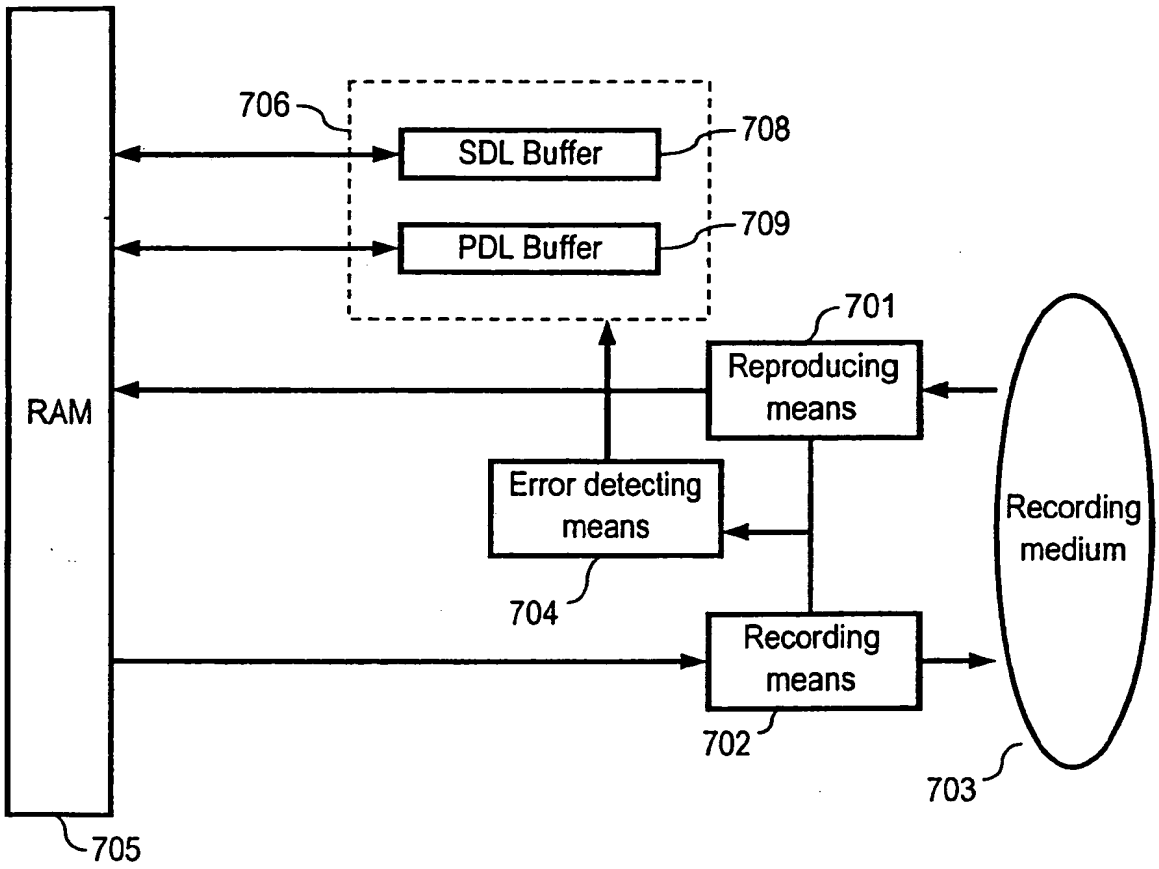
706
SDL Buffer
708
PDL Buffer
709
701
Reproducing means
RAM
Error detecting means
704
Recording medium
Recording means
702
703
705

FIG. 13

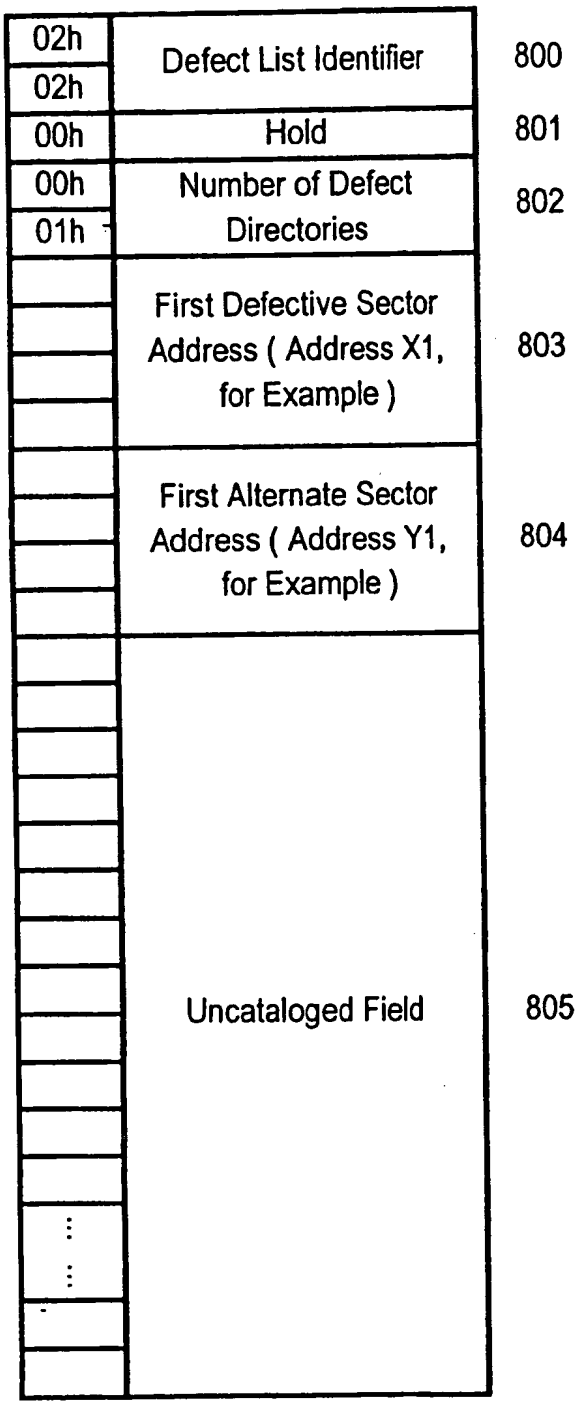

FIG. 14(a)

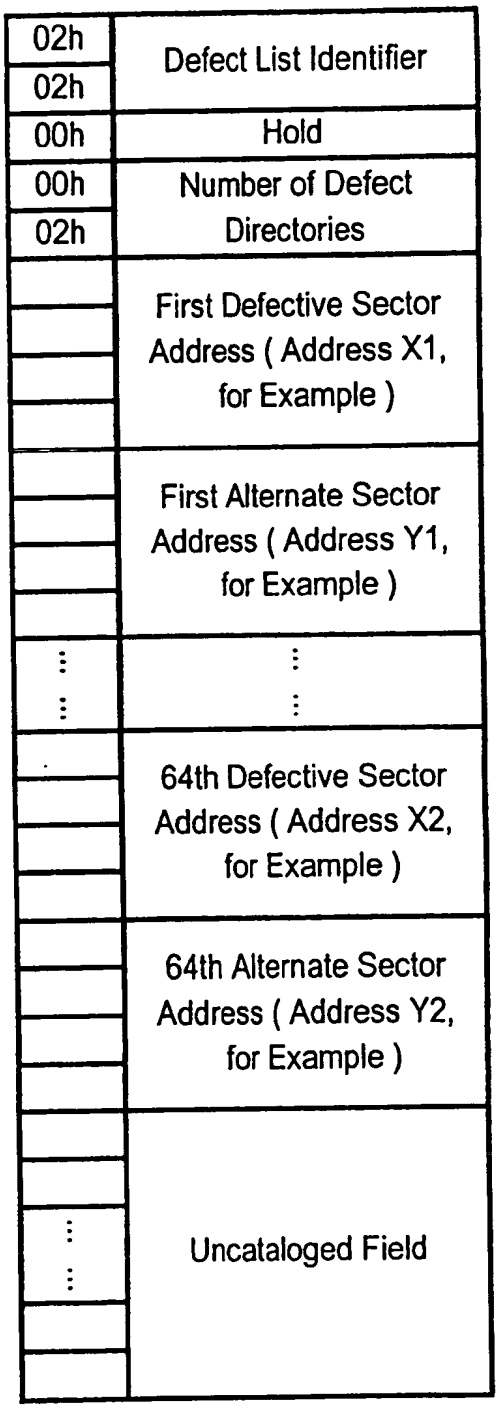

FIG. 14(b)

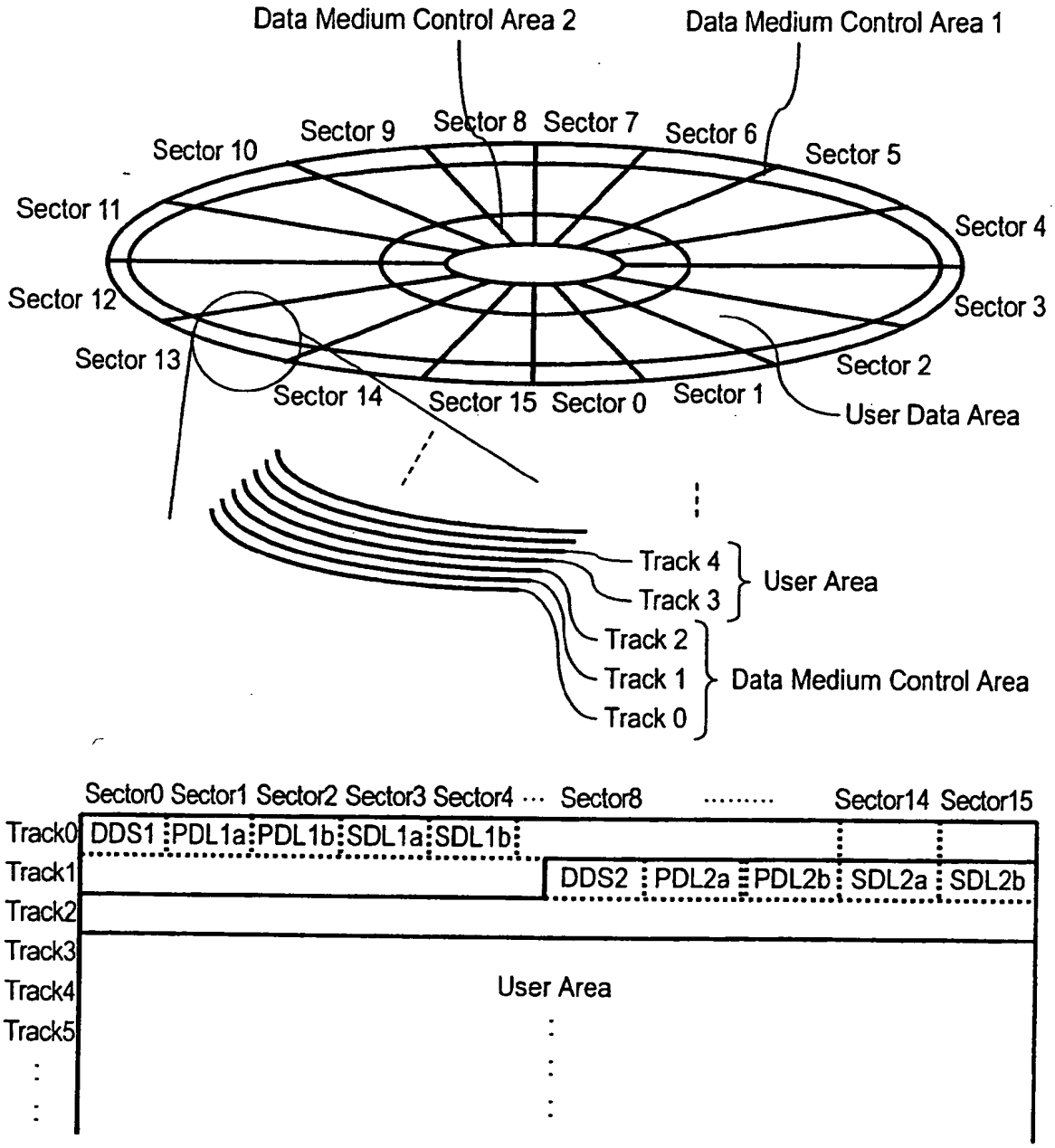
Data Medium Control Area 2
Data Medium Control Area 1
Sector 10
Sector 9
Sector 8
Sector 7
Sector 6
Sector 5
Sector 11
Sector 4
Sector 12
Sector 3
Sector 13
Sector 2
Sector 14
Sector 15
Sector 0
Sector 1
User Data Area
Track 4
Track 3
User Area
Track 2
Track 1
Track 0
Data Medium Control Area
Sector0 Sector1 Sector2 Sector3 Sector4 ··· Sector8 ····· Sector14 Sector15
Track0
DDS1
PDL1a
PDL1b
SDL1a
SDL1b
Track1
DDS2
PDL2a
PDL2b
SDL2a
SDL2b
Track2
Track3
Track4
User Area
Track5

FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP96/02222

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl^6 G11B20/12, 20/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int. Cl^6 G11B20/12, 20/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926 - 1996
Kokai Jitsuyo Shinan Koho 1971 - 1996
Toroku Jitsuyo Shinan Koho 1994 - 1996

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 4-3368, A (Sony Corp.), January 8, 1992 (08. 01. 92) & EP, 452884, A2	1-3, 6-8, 11, 13
Y		4, 5, 12, 9, 10, 14
Y	JP, 61-34773, A (Hitachi, Ltd.), February 19, 1986 (19. 02. 86)(Family: none)	4, 5, 12, 9, 10, 14
A	JP, 4-103082, A (Hitachi Maxell, Ltd.), April 6, 1992 (06. 04. 92)(Family: none)	1 - 14

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
November 5, 1996 (05. 11. 96)	November 19, 1996 (19. 11. 96)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

ABSTRACT / ZUSAMMENFASSUNG / ABREGE

03014964.5

An information storage medium has a user area (UA) used to store user data, a defect management area (DMA) used to store defect information associated with defects on the user area, and an overwrite management area (DMA) used to store overwrite information associated with an overwrite count for the defect management area.